The Relationship between Neuroticism and Intelligence Scores among a Libyan student sample

Khalid M. Elmadani, PhD ; Belinda Winder, PhD & Lee Farrington-flint, PhD

ملخص البحث

يهدف هذا البحث إلى دراسة تأثير سمة العصابية على درجات ذكاء الفرد؛ وقد ضمت العينة (75) طالبا وطالبة من مدينة مصراتة الليبية تراوحت أعمارهم بين (15: 25) سنة أكملوا جميعا مقياس وكسلر-بلفيو لذكاء المراهقين والراشدين، واختبار السلوك العصابي؛ وقد أظهرت النتائج فروق دالة إحصائيا بين الذكور والإناث على اختبار العصابية، بينما لم تكن الفروق على بعد العصابية دالة وفقا لمتغير العمر، كما أظهرت النتائج عدم وجود فروق دالة إحصائيا في درجات الذكاء بين المستويات الثلاثة للعصابية، رغم ذلك، وُجد أن تشتت درجات الاختبارات الفرعية لمقياس وكسلر للذكاء لدى مجموعة الدرجات العصابية العالية كانت أكثر تشتتا من درجات باقي المجموعات، وكانت دالة إكلينيكيا على اختبار الاستدلال الحسابي ، والمعلومات، وسلاسل الأرقام؛ وأظهرت النتائج علاقة عكسية دالة بين درجات العصابية ودرجات الاستدلال الحسابي، المعلومات العامة، ودرجات اختبار تكميل الصور، وظهر دور متغير الجنس بوضوح في اختلاف العلاقة بين الذكاء والعصابية ليس فقط في حجم العلاقة ، بل أيضا في اتجاهها.

Abstract

The study examined the impact of Neuroticism on an individual's intelligence among a Libyan student sample. Seventy-five students aged between 15 to 25 years, completed the Wechsler-Bellevue Intelligence Scale (WBIS the Arabic version) and the Neurotic Behaviour Scale (NBS) to provide measures of Intelligence and Neuroticism scores, respectively. The results showed little difference in either sex or age with regard to differences in neuroticism scores. Furthermore, the findings revealed that there were no significant differences between the three different levels of neuroticism scores and the individuals' performance on the WBIS intelligence scales. However, the scaled scores of the High-neuroticism group on the WBIS subtests were more scatter than other groups and were clinically significant on Arithmetic, Information and Digit Symbol. The results indicated that there were significant negative correlations between neuroticism and Arithmetic, Information and the Picture Completion scale. The role of gender appeared through the differences between males and females in the correlation coefficients between neuroticism and the WBIS scores, not just in the size but also in the direction of the correlation

The Relationship between Neuroticism and Intelligence Scores among a Libyan student sample

Khalid M. Elmadani, PhD[1]; Belinda Winder, PhD[2] & Lee Farrington-flint, PhD[2]

1. Introduction

Neuroticism is considered to be a basic dimension of personality. It has been defined as "A broad dimension of individual differences in the tendency to experience negative, distressing emotions and to possess associated behavioural and cognitive traits" (Costa & McCrae, 1987, p. 301). The dimension of neuroticism encompasses all individuals; differences between people are of degree, not type (Ellenbogen & Hodgins, 2004; Spink, Green, & Jorgensen, 2014). However, much of the findings with regard to the neuroticism trait have been based largely on those derived from western samples and given the increase in cross-cultural studies. One sample that has not been considered is Libyan students, where there are cultural differences, compared to western cultures, in term of language, religion, interests, and customs may vary significantly. Moreover, although relationship between neuroticism and intelligence has been well investigated (e.g., Escorial, Garcia, Cuevas, & Juan-Espinosa, 2006; Moutafi, Furnham, & Paltiel, 2005; Pearson, 1993), very few studies have considered cross-cultural differences in this relationship, nor have been able to account for age and sex differences in the relationship among the two factors. Jorm et al., (1993) reported that " the sex difference in pattern of correlations [between neuroticism and intelligence] is puzzling" (p., 722). Therefore, the current explicitly examined the relationship between neuroticism and intelligence scores among the Libyan student population to fully characterise the nature of this relationship across an Arabic culture.

It is argued that neuroticism can have a significant impact on an individual's life across all ages and across different levels of intelligence. However the results of studies that have examined the relationship between neuroticism scores and intelligence are somewhat conflicting. For example, while some researchers (e.g., Baker & Bichsel, 2006; Demetriou & Kazi, 2000; Demetriou, Kyriakides, & Avraamidou, 2003; Escorial, et al., 2006; Moutafi, Furnham, & Crump, 2003) have found that neuroticism is not related to intellectual abilities, other researchers (e.g., Ackerman & Hegesstad, 1997; Moutafi, et al., 2005) have reported that neuroticism is negatively correlated with general intelligence. In contrast, positive correlations have been found between neuroticism and measures of crystallized ability (Gc) (Pearson, 1993) and fluid intelligence (Gf) (Furnham, Rawles, & Iqbal, 2006). Therefore, the direct nature between neuroticism and intelligence

1- Psychology department, School of Arts, Misurata University-Almadany69@yahoo.com
2 - Psychology department, School of Social Sciences, Nottingham Trent University, UK

scores still remains controversial and requires additional examination.

Similarly, while the previous studies have examined the relationship between neuroticism scores and intelligence, very few have taken into account the contribution of sex and age differences into this relationship. This is important given that previous work has found that both sex and age plays a clear role in explaining differences in individuals' neuroticism and intelligence scores. For example, several studies (e.g., H. Eysenck & Eysenck, 1991; S. Eysenck, Barrett, & Barnes, 1993; Furnham, et al., 2006; Rubinstein & Strul, 2007) have found that neuroticism scores of females were significantly higher than neuroticism scores of males. Lynn and Dai (1993) found that mean scores of Chinese males on WAIS-R was higher on the all WAIS-R IQ scores and subtests (except on Digit Symbol), and that differences were significant (except on Digit Span and Block Design). Similarly, Maleka (1996) found that mean scores of males of the Arabic standardisation sample of the Wechsler -Bellevue Intelligence Scale (WBIS) were higher, but not significant, than mean scores of females on all the WBIS IQ scores and subtests (except Picture Arrangement). In regard to age, there are evidences suggest that neuroticism decreases with increasing of age and the highest level appears during the adolescent stage (H. Eysenck & Eysenck, 1991; Schultz & Schultz, 2005), and that this decline begins almost in the age of 18 (R. R McCrae, 2001a; 2001b) for males and females across different cultures(R. R McCrae, et al., 1999). It is also argued that performance of individuals on tests measuring fluid abilities, such as Performance scale of Wechsler's tests, tends to decline with age, while the performance on tests measuring crystallised abilities, such as Verbal scale of Wechsler's tests, tends to increase with age (Maltby, Day, & Macaskill, 2007; Moutafi, et al., 2003)

The current study also acknowledges cross-cultural differences in the relationship between neuroticism and intelligence scores. Most while previous studies (e.g., S. Eysenck, et al., 1993; Hanin, Eysenck, Eysenck, & Barrett, 1991; Lynn, 1981; Lynn & Martin, 1997; R. R. McCrae, 2001b; Nijenhuis & vanderFlier, 1997; Rushton, Skuy, & Fridjhon, 2002) have found differences in neuroticism and intelligence scores across different cultures have and these findings have contributed to our understanding with regard to the importance of assessing cultural diversity on such intelligence tests. For example, among Cypriot secondary students sample, Demetriou, et al., (2003) found that neuroticism was not related to the cognitive ability. Chamorro-Premuzic, Furnham, & Petrides (2006) reported that the correlation coefficient of emotional stability, low neuroticism scores, among an adult New Zealand sample was positive and significant with verbal cognitive ability, and positive, but not significant, with numerical ability scores. Ettinger and Corr (2001) have not found relationship between neuroticism and intelligence measured by Raven's Advanced Progressive Matrices among British university students, while Moutafi, Furnham, & Tsaousis, (2006) found, among Greek university students, a negative and significant relationship between neuroticism and intelligence measured by Raven's Standard Progressive Matrices.

Among adult American sample, neuroticism was not related to fluid and crystallised intelligence (Baker & Bichsel, 2006), while among British university students there was significant relationship between neuroticism and crystallised intelligence. (Chamorro-Premuzic, Furnham, & Ackerman, 2006).

Using Wechsler Adult Intelligence Scale-Revised (WAIS-R), Holland, Dollinger, Holland and MacDonald (1995) investigated the relationship between neuroticism and intelligence among an American sample and reported that all the correlation coefficients were almost zero. In contrast, Stough, et al., (1996) administrated the same scale to 68 Australian university students and fond negative, but not significant, correlations between neuroticism and Verbal and performance IQ scores.

However, none of these studies have focussed on identifying changes in neuroticism scores across the Libyan culture. Very little is known whether the same relationship between intelligence and neuroticism scores can be generalised to the Libyan culture. Therefore, the current work explicitly examines the relationship between neuroticism and intelligence scores among Libyan students while taking into account the possible influence of sex and age-related differences. This will provide a clearer and more detailed understanding of the relations between neuroticism and intelligence scores.

The current work further investigates the relationship between intelligence and neuroticism scores across a sample of Libyan students. Specifically, the current work examines effects of neuroticism on students cognitive abilities after the effects of sex and age have been taken into account to fully characterise the nature of the relationship between neuroticism and intelligences scores fully. The current work addresses three important questions. First, are there age and sex differences on the Libyan student's scores on the neuroticism scale? Second, does the students' performance on the WBIS scales and subtests differ according to their level of neuroticism (low, medium, and high)? Third, is there a relationship between neuroticism and intelligence scores once age and sex have been taken into account?

2. Method

2.1. Participants

Seventy-five Libyan students (38 males and 37 females) participated in the study. The age of the students ranged from 15 to 25 years, with a mean age of 19 years 3 months (SD = 2 years, 9 months). All the participants were attending secondary school or university and all spoke Arabic language as native speakers.

Table 1

Number of Participants by Age and Sex

	Sample size		
Age categories	*Female*	*Male*	*Total*
15-17	*08*	*07*	*15*
18-19	*18*	*13*	*31*
20-24	*11*	*13*	*24*
25-29	*01*	*04*	*05*
Total	*38*	*37*	*75*

2.2. Materials

2.2.1. Neurotic Behaviour Scale (NBS)

The Neurotic Behaviour Scale is a specifically designed test of Neuroticism to measures neuroticism traits among a Libyan population (see Elmadani, 2001). The test consists of 39 individual items designed to assess seven facets of neuroticism: anxiety, inferiority complex, reactive sensitivity, body disorder, thinking, social relations and sleeping disorder. Each participant is required to provide a yes or no answer to each statement and there is no set time limit for completion of the scale. In this task, 33 items measure neuroticism and the remaining 6 items are a measure of social desirability. As found in Elmadani (2001) the internal consistency and the split-half reliability of the scale among a Libyan population are high (.90, N = 100, and .77, N = 50, respectively) as well as the concurrent validity which is based on the scale's correlation with the Eysenck Personality Inventory ($r = .74$, $N = 100$, $P < .01$).

2.2.2. Wechsler -Bellevue Intelligence Scale (WBIS),

The *Wechsler -Bellevue Intelligence Scale (*WBIS) is the most widely used measure of intelligence among Arabic societies (Maleka, 1996). The WBIS was designed to measure global intelligence scores alongside separate measures of verbal intelligence and performance intelligence. The WBIS consist of 11 subtests, six of which are measures of verbal intelligence and five subtests are measure the performance intelligence. The verbal intelligence subtests comprise of Information, Digit Span, Vocabulary, Arithmetic, Comprehension, and Similarities. The performance intelligence scores comprises of subtest of Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Digit Symbol. To calculate Verbal and Performance intelligence scores, the scaled scores of relevant subtests sum and convert to standard scores (M = 100 and SD = 15). The Full Scale intelligence score is obtained by combining the scaled scores of the 11 subtests and converting the sum to the standard score.

1.1.1.1.1 2.3. Procedure

Students were selected randomly from their schools' registers and tested individually in their schools by the researcher using the Arabic language. Full written informed consent was obtained from participants or their parents or guardians (if the participant was under 18) before testing. All the participants first completed the NBS followed by the WBIS. The ethical practices of psychological research have been followed throughout the study. In order to apply the statistical processes, participants were divided into four age groups (group one: 15-17, group two: 18-19, group three: 20-24 and group four: 25-29) according to the age groups of the WBIS, and into three levels of neuroticism according to the norms of the NBS T. norms (M = 50 and SD = 10). Participants with below 40, between 40 and 60, and higher than 60 were allocated to low, medium, and high neuroticism groups, respectively.

3. Results

3.1. Differences in Neuroticism Scores according to Sex and Age

The first set of analyses examines age and sex differences on the students neuroticism scores (NBS). Table 2 summarises the means (and standard deviations) of the students' neuroticism scores according to sex and age group. As shown in Table 2, there appears to be differences in neuroticism scores according to sex; the mean scores of females are higher than those of males, while there are slight differences between means across age groups. The standard deviations appear relatively homogenous among males and females, and there are slight differences across age groups; using the Levene's test of equality of error variances showed that the differences were not significant (F (1, 73) = .568, p = .454, and F (3, 71) = .828, p = .483, respectively).

Table 2

Means and Standard Deviation of Neuroticism Scores of the Males and Females of the Study Sample with Age

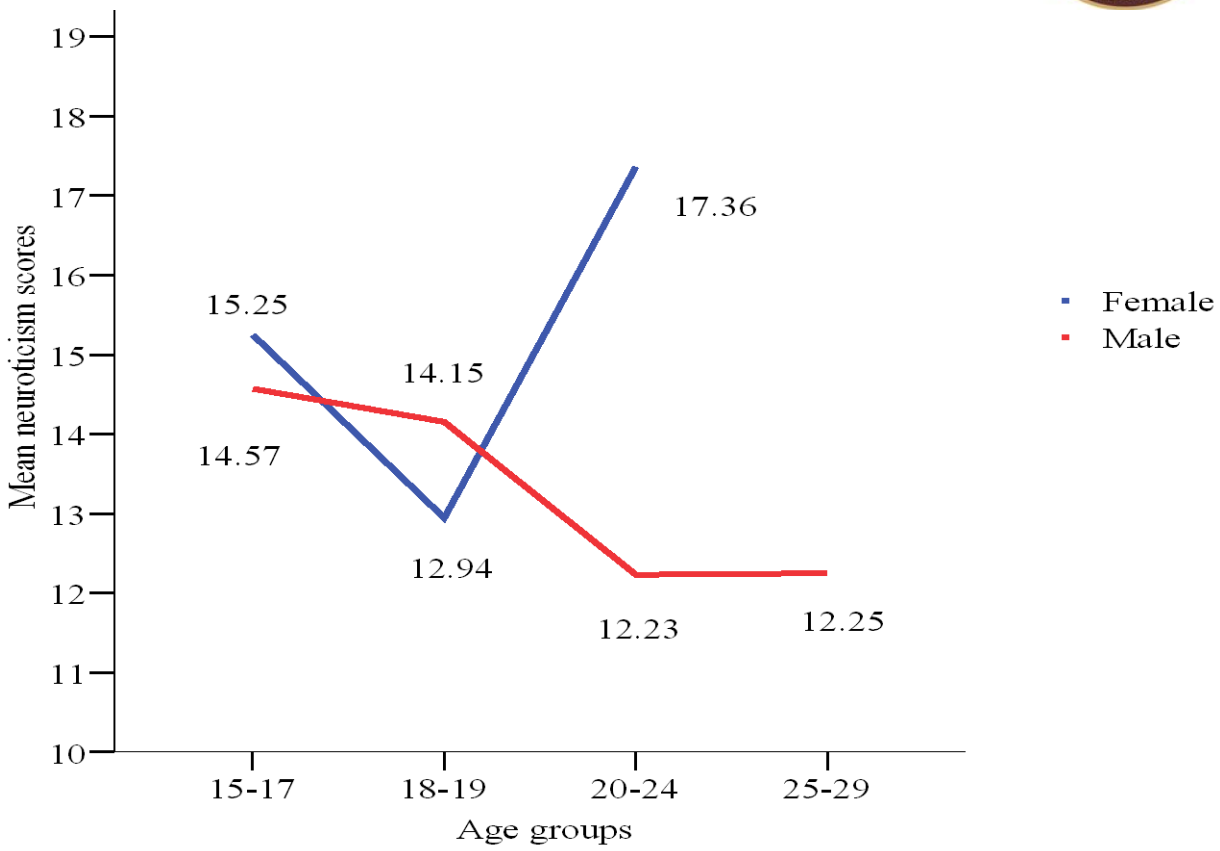
Categories of age	Mean neuroticism score		Standard deviation		Sample size	
	Male	Female	Male	Female	Male	Female
15 -17	14.57	15.25	3.91	4.13	7	8
18 -19	14.15	12.94	4.86	4.70	13	18
20 -24	12.23	17.36	3.59	5.85	13	11
25 -29	12.25	0	5.19	0	4	1

Note. The 25-29 year group involves only one female volunteer; therefore, the mean has not been calculated.

A two- way ANOVA was carried out on variance on the date. The main effect of sex on neuroticism scores was significant (F (1, 67) = 7.665, p = .007, partial η^2 = .103), while the main effect of age group factor was not significant (F (3, 67) = 1.332, p = .271, partial η^2 = .056). The interaction between the factor of sex of participants and the factor of their age group was significant (F (3, 67) = 3.626, p = .017, partial η^2 = .140). The interaction between both factors appear clearly on the *Figure 1* where the average degree of neuroticism of males tended to decrease with increasing age, while the average degree of neuroticism of females rose sharply in the 20:24 age group. The difference between mean scores of female in the 18:19 age group and in the 20:24 age group was significant, t (27) = -2.240, p = .034 (two tailed), d = .80. Moreover, differences between males and females throughout age groups were not significant except in the 20:24 age group: t (22) = -2.636, p = .015 (two tailed), d = .96.

Figure 1

Means plots of neuroticism scores of males and females according to age



1.1.1.1.1.1 3.2. Relationship between Intelligence and level of neuroticism

To further examine the role of neuroticism on an individual's intelligence score, we examined differences in the students performance on the WBIS scales and on each of the different sub-tests on the intelligence measure (as measured on the WBIS) according to the individuals level of neuroticism score (low, medium or high). The means (and standard deviations) for intelligence scores according to their levels of neuroticism are summarised in Table 3.

Table 3

Means and Standard Deviation of the Study Sample on the WBIS According to their Level of Neuroticism

Subtests	Mean scores			Standard deviation		
	Low	Medium	High	Low	Mediu m	High
Full Scale IQ	96.74	96.98	93.00	12.53	9.15	9.87
Verbal IQ	93.21	93.83	88.00	13.56	10.80	8.01
Performance IQ	98.26	99.37	99.20	11.76	9.85	10.64
Vocabulary	10	10.01	9.60	2.31	2.13	1.65
Similarities	11.47	10.74	10	1.95	1.98	2.71
Arithmetic	7.05	6.98	5.30	2.84	2.89	2.63
Digit Span	10.16	10.04	9.50	2.41	3.02	2.46
Information	9	8.87	7	2.45	2.48	1.83
Comprehension	9.68	10.09	10.50	2.73	2.87	2.59
Picture Completion	9.68	9.35	8.90	2.29	1.95	2.73
Digit Symbol	10.74	11.30	11.60	2.05	1.94	1.65
Block Design	10.16	10.80	10.50	2.83	2.60	2.12
Object Assembly	11.37	10.91	10.60	2.45	2.44	2.12
Picture Arrangement	9.53	9.24	9.60	1.98	1.86	3.24

Note. Means on the full, verbal and performance scales are for IQs, while on the all subtests means are for scaled scores. *N* of low group was 19. *N* of medium group was 46. *N* of high group was 10.

As shown in Table 3, the mean scores of the high-neuroticism group were lower than the other groups on all WBIS IQ scores and on all of the subtests (except the Comprehension and Digit Symbol subtests). One-way ANOVA's confirmed however that there were no significant differences between the three groups on Full Scale IQ scores, F (2,72) = .677, p = .511, η^2 = .018, the Verbal IQ scores, F (2,72)

= 1.109, p = .335, η^2 = .030 and on the Performance IQ scores, $F(2,72)$ = .076, p = .927, η^2 = .002.

Table 3 shows also that, the means of PIQ of the three groups are higher than the VIQ. Using the Paired Samples *t*-test, the differences between them were significant among the low group, t (18) = -3.550, p = .002 (two-tailed), d = 0.81; medium group, t (45) = -3.418, p = .001 (two-tailed), d = 0.50; and the high group, t (9) = -2.830, p = .02 (two-tailed), d = 0.90. However, the only difference that is clinically significant was among the high level of neuroticism group where the mean difference between VIQ and PIQ was 11-IQ points[3].

Moreover, although there are no significant differences between the three groups on all the subtests, differences between means of the scaled scores within each group have clinical significations. In this respect, one of the methods that have been used to analyse the performance of individuals on the WBIS is the test profile scatter (Maleka, 1996), which is the difference between the scaled scores that are obtained by the examinee on all the subtests. One of the ways of measuring test profile scatter is called the "Vocabulary Scatter". It is estimated by computing the differences between the scaled scores of each subtest and the scaled score of the Vocabulary test. This method assumes that Vocabulary is the best measure of the original level of an individual's mental abilities in which is able to estimate the deterioration in the present time. As a result, a difference of 2-scaled scores or more between the scaled scores of each subtest and the scaled score of the Vocabulary is a clinically important indicator (Maleka, 1996).

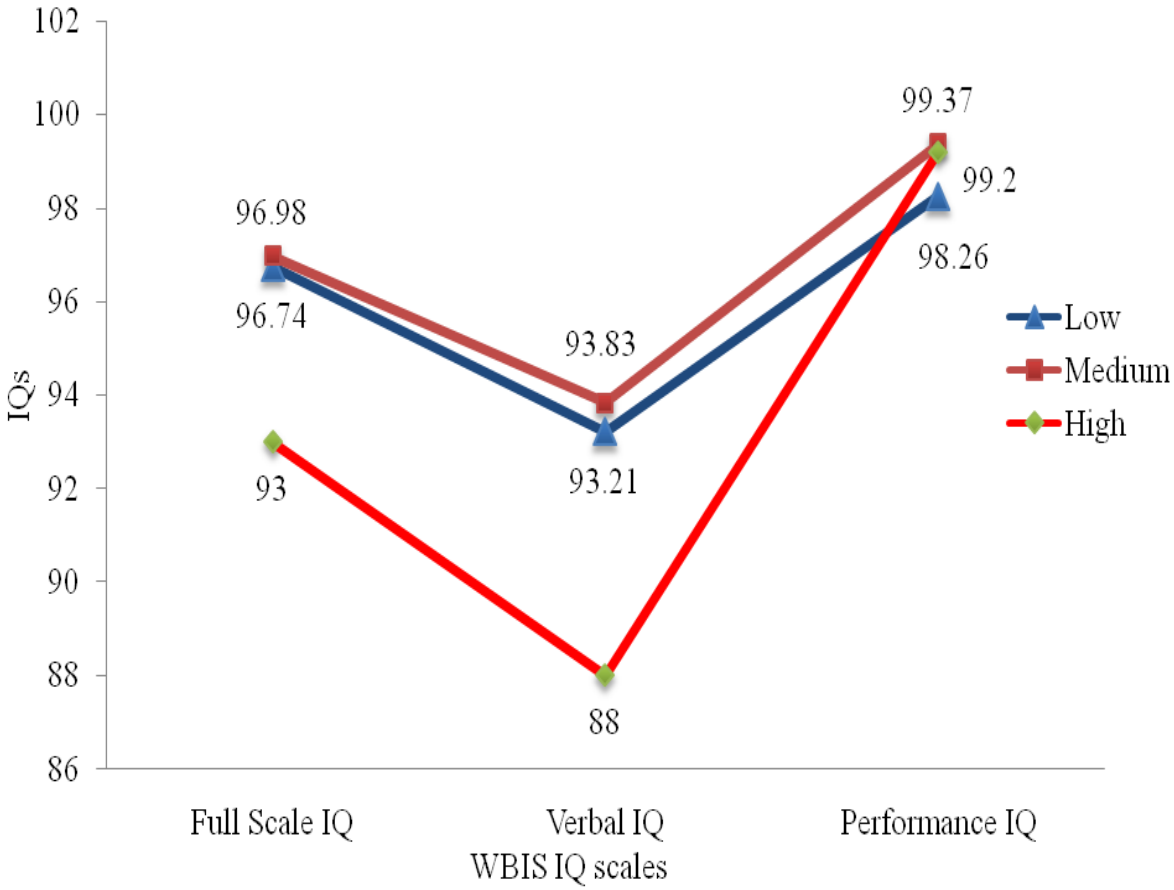
Using the method of test profile scatter appeared that the scaled scores of the high group on the WBIS subtests were more scatter than other groups. Comparing the vocabulary scatter, the Arithmetic test is the only subtest that significantly deviated from the Vocabulary subtest among the low and medium groups (-2.95and -3.03, respectively)[4], while among the high group there were clinical signification deviations on the Arithmetic = -4.3, Information = -2.6, and on the Digit Symbol = 2.01.

[3]-A difference of more than 10-IQ points is a clinically important indicator (Maleka, 1996)

[4] A difference of 2-scaled scores or more is a clinically important indicator (Maleka, 1996)

Figure 2

Means of WBIS IQ scores according to level of neuroticism



3.3. Sex and age Differences on the Relation between Neuroticism and Intelligence Scores

The final step was to sex and age differences in the students' neuroticism scores and WBIS IQ scores and subtests according to sex (male and female students) and the four Age groups. As Table 4 reveals, males' correlations were considerably higher on the majority of the WBIS IQ and subtests than females. For example, correlation of female on FSIQ was almost zero while for males was higher and significant (r = -.36, N = 37, P = .031, two-tailed).with a moderate effect size. However, using the Fisher's z_r transformation of the correlation coefficient, there was no significant difference between both correlations. The z value was 1.32, p = .09, indicating that the correlations were not significantly different. Similarly, on the Object Assembly, correlation of female was almost zero while for males was higher and significant (r = -.35, N = 37 P = .033, two-tailed), with a moderate effect size, z = 1.22, p = .11. Nevertheless, the correlations between neuroticism and intelligence scores among the female sample were higher than those of males on the Arithmetic and Digit Symbol subtests. As shown in Table 4, the Pearson correlation of females

on the Arithmetic was significant and higher than the correlation of males on the same scale (r = -.33, N = 38, P = .031, two-tailed, and r = -.23, N = 37, P = .170, two-tailed, respectively). Moreover, on the Digit Symbol, the correlation for males was almost zero, while for females it was higher and significant (r = -.34, N = 38, p = .035, two-tailed). However, using the Fisher's z test, there were no significant differences between these correlations on both the Arithmetic and the Digit Symbol subtests, z = .453, p = .32, and z = .30, p = .10, respectively.

Table 4

Pearson's Correlation between Neuroticism and WBIS IQs and Subtests among the Libyan Sample

Subtests	Sex		Age groups			
	Male	Female	15-17	18-19	20-24	25-29
Full Scale IQ	-.36*	.06	.210	-.133	-.342	-.698
Verbal IQ	-.32	.04	.232	-.159	-.296	-.94*
Performance IQ	-.27	.18	.093	.082	-.310	-.053
Vocabulary	-.22	.08	.220	-.113	-.080	-.93*
Similarities	-.20	-.11	.070	.020	-.171	-.712
Arithmetic	-.23	-.33*	-.078	-.251	-.387	-.91*
Digit Span	-.27	.08	-.110	-.036	-.125	-.465
Information	-.23	-.23	.028	-.134	-.41*	-.97**
Comprehension	-.03	.25	.68**	.061	.005	-.798
Picture Completion	-.32	-.06	.113	-.155	-.63**	.103
Digit Symbol	-.04	.34*	.374	.247	.062	.280
Block Design	-.19	.10	-.200	.091	-.135	-.428
Object Assembly	-.35*	-.07	.110	-.210	-.51*	.097
Picture Arrangement	-.22	.17	-.179	.022	.136	-.212

Note. Number of Female = 38; Male = 37; 15-17 = 15; 18-19 = 31; 20-24 =

24; 25-29 = 5. * $p < .05$. ** $p < .01$.

With respect to age variable, correlations of the older students were considerably higher on the majority of the WBIS IQ and subtests than the younger student particularly among the 25:29 age group, where there were negative and significant correlations on the Verbal IQ, Vocabulary, Arithmetic and Information, while among 15:17 age group there was only one significant correlation on the Comprehension subtest.

To identify the relationship between neuroticism and WBIS IQ and subtests scores without the effect of variables of sex and age, Partial Correlations have been calculated and presents on Table 5. As shown in Table 5, the correlation coefficients declined when they were controlling the sex variable. However there were very slight differences when they were controlling the age variable. The correlation between neuroticism and Arithmetic subtest was the only one correlation that remaining significant.

Table 5

Partial's Correlation between Neuroticism and WBIS IQs and Subtests among Libyan Sample controlling the sex and age variables

Subtests	Pearson correlation	Partial correlation		
		Controlled variables		
		Age	Sex	Age & sex
Full Scale IQ	-.19	-.20	-.15	-.16
Verbal IQ	-.19	-.20	-.14	-.16
Performance IQ	-.06	-.06	-.04	-.04
Vocabulary	-.10	-.10	-.06	-.07
Similarities	-.12	-.11	-.15	-.15
Arithmetic	-.30**	-.30*	-.25*	-.26*
Digit Span	-.09	-.09	-.08	-.10
Information	-.27*	-.27*	-.22	-.23
Comprehension	.07	.07	.10	.10

Picture Completion	-.23*	-.23*	-.19	-.19
Digit Symbol	.20	.21	.20	.20
Block Design	-.06	-.06	-.04	-.05
Object Assembly	-.22	-.22	-.19	-.20
Picture Arrangement	.02	.03	.00	.00

* $p < .05$. ** $p < .01$.

1.1.1.1.2 4. Discussion and Conclusions

The main aim of this study was to identify and explain the impact of neuroticism on an individual's intelligence as measured by the eleven subtests of WBIS among a Libyan sample, and to examine the influence of gender, and age of the subjects on this association. The first question of this study enquired about whether the mean scores of individuals on the neuroticism scale differ according to the sex and age. In line with most previous studies (e.g., Courbalay, Deroche & Woodman, 2016; Elmadani, 2001; H. Eysenck & Eysenck, 1991a; S. Eysenck et al., 1993; Rubinstein & Strul, 2007), the results showed significantly higher levels of neuroticism for females than males.

The main effect of sex on neuroticism scores was medium and significant, while the main effect of age was small and not significant. Moreover, the interaction between sex and age was significant with a large effect size. The interaction appeared clearly on the 20-24 age group where the difference between sexes was significant in favour of females, with a large effect size; 96% of the overall variance was accounted for by sex. Moreover, among the female sample, there was a significant difference between the 18-19 and 20-24 age groups in favour of the latter group with a large effect size; 80% of the overall variance being accounted for by age. These findings are in contrast with previous studies (i.e., H. Eysenck & Eysenck, 1991a; McCrae et al., 1999; McCrae, 2001a; 2001b) which have argued that neuroticism decreases with advancing age, and that this decline occurs similarly for males and females across different cultures.

McCrae et al., (1999) suggested that "personality traits change in response to social tasks" (p., 474). Therefore, these differences could be due to social and cultural factors in Libya, which might increase the level of neuroticism among females in this age group. One of these factors could be that at age 20–24, females graduate from universities or higher institutes and begin looking for a suitable job. In Libya, and most of other Arab countries, there is little demand for women's employment; males in Libya have more chance of finding a job (Keddie, 2007). Another factor could be that, in Libya, this age is critical with respect to marriage and family formation. Girls are under the control of parents until they marry. This

situation is completely different for males, as at this age they are mostly set free from the control of parents and are not under pressure to marry.

The second question was whether the performance of individuals on the WBIS differs according to their level of neuroticism. The findings showed that there were no almost differences between the three groups on the Performance IQ, while the lowest means were for the high-level neuroticism group on all the other WBIS IQs and subtests except the Comprehension and Digit Symbol. However, differences between the three groups were non-significant. Means of the medium and low-level groups on all IQs and subtests were small and on some subtests were similar. These findings support results of the study of Stewart, Deary and Ebmeier (2002), where they found that there were no significant difference between mean scores of individuals with low neuroticism and individuals with high neuroticism scores on the Digit-Symbol and the Digit Span subtests. Similarly, these findings are in line with the other studies (e.g., Escorial, et al., 2006) that administrated cognitive tests rather than WAIS and found that there were no significant differences between the averages of the three levels of neuroticism groups.

A possible explanation for the low affect of neuroticism on the performance of the participants on the WBIS may relate to the level of arousal among the participants in completing the intelligence and neuroticism tests within the current study. Previous researchers reported that the negative relationship between neuroticism and intelligence scores is largely observable under stressful or arousing conditions (Chamorro-Premuzic, Furnham, & Petrides, 2006; Moutafi et al., 2006), and intelligence would decrease with negative affectivity such as anxiety, worry, tension (Zeidner & Matthews, 2000). Bishop, Fossella, Croucher, and Duncan (2008) reported that performance on intelligence tests increases conscious activity in the cerebral cortex; this high activity may increase the cortical arousal as Eysenck (1967) suggests, performance may be influenced by cortical arousal and stimulation on the task. However, the participants in this study were all volunteers, and they know in advance that the results of their performance on the neuroticism and intelligence tests will not affect them personally; this may reduce test anxiety and conscious activity in the cerebral cortex. Therefore, the level of cortical arousal among the participants in the current study may have not increased to the extent that negatively affects their performance on the WBIS.

Nevertheless, analysing the performance of examinees on the WBIS, using the method of test profile scatter, led to clinically significant differences between means of the scaled scores within each group. Findings showed that the scaled scores of the High group on the WBIS subtests are more scatter than other groups. In this respect, there were clinically significant deviations on the Arithmetic scale among the three groups, and on the Information and Digit Symbol among the High level of neuroticism group. These findings indicate that a high level of neuroticism impacted negatively the performance of the Libyan samples on the Arithmetic, Information and Digit Symbol subtests.

Moreover, this study found that Verbal-Performance IQ discrepancy was only significantly large among the high neuroticism group. This finding support the notion that differences between verbal IQ and performance IQ scores increase among individuals who have difficulties in adaptation or have neurotic disorders (Maleka, 1996). However, it is remarkable although all the participants in this study were university and secondary school students their performance on the VIQ scale was significantly lower than their performance on the PIQ scale; in particular, on the Arithmetic where mean scores of them was under the subtest's norms mean of 10 among all the three groups. The researcher assumes that the factor that may be behind this result is due to the nature of the Verbal subtests themselves in which refers to knowledge and skills that are primarily influenced by environmental and cultural factors (H. Eysenck, 1995; Maltby, et al., 2007; Wechsler, 1997). Therefore, the researcher supposes weak influence of educational and social institutions such as school, family and so on in Libya, as a developing country, in developing the knowledge and verbal abilities for their individuals.

The third question in this study examined how sex and age may mediate the relationship between neuroticism and intelligence test scores. The results showed that there were small negative correlations between neuroticism and most of the WBIS IQs and subtests scores; indicating that the trait of neuroticism has a slight affect on the participants' intelligence scores. This may because the low level of arousal among the participants in the current study as mentioned in a previous section, which discussed the role of level of neuroticism on intelligence scores. These findings supports the study of Holland et al. (1995), and Stough et al. (1996), who found that neuroticism has a little affect on an individual's intelligence scores as measured by the Wechsler Adult Intelligence Scale-Revised.

The current study examined the role of age and sex in the magnitude of the relationship between neuroticism and intelligence scores. The conclusion that arose from the correlation analyses was that the relationship between neuroticism and intelligence was stronger among males as compared to females, particularly for the Full Scale IQ, Verbal IQ, Vocabulary, Picture Completion and Object Assembly, and was stronger among females as compared to males on Arithmetic and Digit Symbol subtests, and that was stronger among the older students than the younger ones, particularly on the Full Scale IQ, Verbal IQ, Arithmetic and Information subtests. However, using the Fisher's z transformation of the correlation coefficient, there were no significant differences between females' correlations and males' correlations, and between correlations of the younger students and the older students on all the WBIS IQ scales and subtests. Thus, the observed sex and age differences in the relationship between neuroticism and intelligence scores might be the result of chance factors; therefore it may be limited to the current sample. Moreover, using the partial correlation, findings of this study indicate that both sex and age had a little effect in the relationship between neuroticism and all the WBIS IQ scales and subtests scores, since there

were very slight differences when controlling for sex and age.

Overall, the findings from this study have illustrated how sex and age differences are important in explaining differences in neuroticism and intelligence scores separately but they have a little effect on the relationship between neuroticism and intelligence scores. However, It should be noted that this study utilised a student sample, and given that the materials of the study need about 90 minutes to be completed, and the difficulties in recruiting this sample, the range of age of participants (15-26) and the size of sample (N = 75) were relatively small, which may restricts the generalisability of the present results.

1.1.1.1.3 References

1. Ackerman, P., & Hegesstad, E. (1997). Intelligence, Personality and Interests: evidence for overlapping traits. *Psychological Bulletin, 121*(2), 219–245.
2. Baker, T., & Bichsel, J. (2006). Personality Predictors of Intelligence: differences between young and cognitively healthy older adults. *Personality and Individual Differences, 41*(5), 861-871.
3. Bargeman, C. S., Chipuer, H. M., Plomin, R., Pedersen, N. L., McClearn, G. E., Nesselroade, J. R., et al. (1993). Genetic and Environmental Effects on Openness to Experience, Agreeableness, and Conscientiousness: an adoption/twin study. *Journal of Personality, 61*(2), 159-179.
4. Bishop, S., Fossella, J., Croucher, C., & Duncan, J. (2008). COMT val158met genotype affects recruitment of neural mechanisms supporting fluid intelligence. Cerebral Cortex, 18(9), 2132-2140.
5. Eysenck, H. (1967). The biological basis of personality. Springfield, IL: Charles C. Thomas.
6. Chamorro-Premuzic, T., Furnham, A., & Ackerman, P. L. (2006). Ability and personality correlates of general knowledge. *Personality and Individual Differences, 41*(3), 419-429.
7. Chamorro-Premuzic, T., Furnham, A., & Petrides, K. (2006). Personality and Intelligence: The relationship of Eysenck's giant three with verbal and numerical ability. *Journal of Individual Differences, 27*(3),147-150.
8. Costa, P. T., & McCrae, R. R. (1987). Neuroticism, Somatic Complaint and Disease: Is the bark worse than the bite? *PJournal of Personality, 55*(2), 299-316.
9. Courbalay, A., Deroche, T. & Woodman, T. (2016). Women's greater fear of pain is mediated by neuroticism. *Psychologie Française*, 61(2) 153-162.
10. Demetriou, A., & Kazi, S. (2000). *Unity and Modularity in the Mind and the Self: Studies on the relationships between self-awareness, personality, and intellectual development from childhood to adolescence*. London: Routledge.

11. Demetriou, A., Kyriakides, L., & Avraamidou, C. (2003). The missing link in the relations between intelligence and personality. *Journal of Research in Personality*, *37*(6), 547-581.
12. Ellenbogen, M., & Hodgins, S. (2004). The Impact of High Neuroticism in Parents on Children's Psychosocial Functioning in a Population at High Risk for Major Affective Disorder A Family-environmental Pathway of Intergenerational Risk. *Development and Psychopathology*, *16*(01), 113-136.
13. Elmadani, K. (2001). *Construction a Standardized Scale for the Neurotic Behavior of the Secondary School Students in Misurata.* 7th October, Misurata.
14. Escorial, S., Garcia, L. F., Cuevas, L., & Juan-Espinosa, M. (2006). Personality Level on the Big Five and the Structure of Intelligence. *Personality and Individual Differences*, *40*(5), 909-919.
15. Ettinger, U., & Corr, P. J. (2001). The Frequency Accrual Speed Test (FAST): Psychometric intelligence and personality correlates. *European Journal of Personality*, *15*(2), 143-152.
16. Eysenck, H. (1995). Can We Study Intelligence Using the Experimental Method. *Intelligence*, *20*(3), 217-228.
17. Eysenck, H., & Eysenck, S. (1991). *Eysenck Personality Questionnaire*. Alexandria: Library of University Knowledge.
18. Eysenck, S., Barrett, P. T., & Barnes, G. E. (1993). A Cross-culture Study: Canada and English. *Personality and Individual Differences*, *14*(1), 1-9.
19. Furnham, A., Rawles, R., & Iqbal, S. (2006). Personality, intelligence and proof-reading. *Personality and Individual Differences*, *41*(8), 1457-1467.
20. Hanin, Y., Eysenck, S., Eysenck, H., & Barrett, P. (1991). A Cross-culture Study: Russia and English. *Personality and Individual Differences*, *12*(3), 265-271.
21. Holland, D. C., Dollinger, S. J., Holland, C. J., & MacDonald, D. A. (1995). The Relationship between Psychometric Intelligence and the Five-Factor Model of Personality in a Rehabilitation Sample. *Journal of Clinical Psychology*, *51*(1), 79-88.
22. Jorm, A. F., Mackinnon, A. J., Christensen, H., Henderson, S., Scott, R., & Korten, A. (1993). COGNITIVE-FUNCTIONING AND NEUROTICISM IN AN ELDERLY COMMUNITY SAMPLE. *Personality and Individual Differences*, *15*(6), 721-723.
23. Keddie, N. (2007). Women in the Middle East. New Jersey: Princeton University Press.

24. Lynn, R. (1981). Crouss-culture Differences in Neuroticism , Extraversion and Psychoticism. In R. Lynn (Ed.), *Dimensions of Personality: Papers in Honour of H.J. Eysenck* (pp. 263-286). Oxford: Pergamon Press.

25. Lynn, R., & Dai, X. Y. (1993). SEX-DIFFERENCES ON THE CHINESE STANDARDIZATION SAMPLE OF THE WAIS-R. *Journal of Genetic Psychology*, *154*(4), 459-463.

26. Lynn, R., & Martin, T. (1997). Gender Differences in Extraversion, Neuroticism, and Psychoticism in 37 Countries. *Journal of Social Psychology, 137*(3), 369–373.

27. Maleka, L. (1996). *Wechsler-Bellevue Adult and Adolescence Intelligence Scale, Arabic Technical Manual*. Cairo: Egyptian revival library.

28. Maltby, J., Day, L., & Macaskill, A. (2007). *Personality, Individual Differences and Intelligence*. London: Pearson Education Limited.

29. McCrae, R. R. (2001a). 5 Years of Progress: A Reply to Block. *Journal of Research in Personality, 35*(1), 108–113.

30. McCrae, R. R. (2001b). Trait Psychology and Culture: Exploring intercultural comparisons. *Journal of Personality, 69*(6), 819-846.

31. McCrae, R. R., Costa, P. T., Pedroso de Lima, M., Simões, A., Ostendorf, F., Angleitner, A., et al. (1999). Age Differences in Personality Across the Adult Life Span: Parallels in five cultures. *Developmental Psychology, 35*(2), 466-477.

32. Moutafi, J., Furnham, A., & Crump, J. (2003). Demographic and Personality Predictors of Intelligence:A Study Using the Neo Personality Inventoryand the Myers-Briggs Type Indicator. *European Journal of Personality, 17*(1), 79-94.

33. Moutafi, J., Furnham, A., & Paltiel, L. (2005). Can personality factors predict intelligence? *Personality and Individual Differences, 38*(5), 1021-1033.

34. Moutafi, J., Furnham, A., & Tsaousis, I. (2006). Is the relationship Between Intelligence and Trait Neuroticism Mediated by Test Anxiety? *Personality and Individual Differences, 40*(3), 587-597.

35. Nijenhuis, J. T., & vanderFlier, H. (1997). Comparability of GATB scores for immigrants and majority group members: Some Dutch findings. *Journal of Applied Psychology, 82*(5), 675-687.

36. Pearson, P. R. (1993). Cognitive Functioning and Neuroticism in Elderly Psychiatric Patients. *Personality and Individual Differences, 14*(1), 265–266.

37. Rubinstein, G. (2005). The Big Five among Male and Female Students of Different Faculties. *Personality and Individual Differences, 38*(7), 1495-1503.

38. Rubinstein, G., & Strul, S. (2007). The Five Factor Model (FFM) Among Four Groups of Male and Female Professionals. *Journal of Research in Personality, 41*(4), 931-937.

39. Rushton, J. P., Skuy, M., & Fridjhon, P. (2002). Jensen effects among African, Indian, and White engineering students in South Africa on Raven's Standard Progressive Matrices. *Intelligence, 30*(5), 409-423.

40. Schultz, D. P., & Schultz, S. E. (2005). *Theories of Personality* (Eighth edition ed.). Belmont: Thomson Wadsworth.

41. Spink, G., Green, T., & Jorgensen, R. (2014). Openness moderates the relationship between modern health worries and neuroticism. *Personality and Individual Differences*, 70, 35-38.

42. Stewart, M., Deary, I., & Ebmeier, K. (2002). Neuroticism as a Predictor of Mood Change: the effects of tryptophan depletion. *The British Journal of Psychiatry, 181*(3), 242-247.

43. Stough, C., Brebner, J., Nettelbeck, T., Cooper, C. J., Bates, T., & Mangan, G. L. (1996). The relationship between intelligence, personality and inspection time. *British Journal of Psychology, 87*, 255-268.

44. Wechsler, D. (1997). *Manual for the Wechsler Adult Intelligence Scale- Third Edition*. San Antonio, TX: The Psychological Corporation.